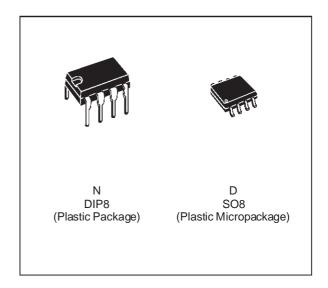


TL072 TL072A - TL072B

LOW NOISE J-FET DUAL OPERATIONAL AMPLIFIERS

- WIDE COMMON-MODE (UP TO Vcc⁺) AND DIFFERENTIAL VOLTAGE RANGE
- LOW INPUT BIAS AND OFFSET CURRENT
- LOW NOISE $e_n = 15 \text{nV/Hz}$ (typ)
- OUTPUT SHORT-CIRCUIT PROTECTION
- HIGH INPUT IMPEDANCE J-FET INPUT STAGE
- LOW HARMONIC DISTORTION: 0.01% (typ)
- INTERNAL FREQUENCY COMPENSATION
- LATCH UP FREE OPERATION
- HIGH SLEW RATE: 16V/µs (typ)



DESCRIPTION

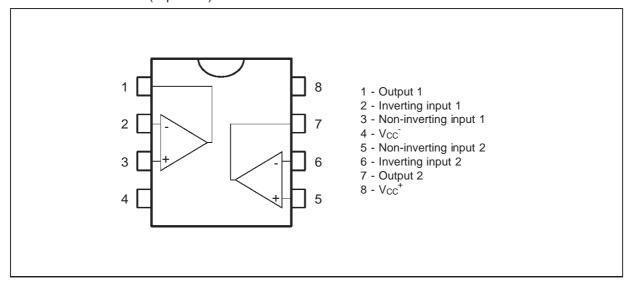
The TL072, TL072A and TL072B are high speed J–FET input dual operational amplifiers incorporating well matched, high voltage J–FET and bipolar transistors in a monolithic integrated circuit.

The devices feature high slew rates, low input bias and offset current, and low offset voltage temperature coefficient.

ORDER CODES

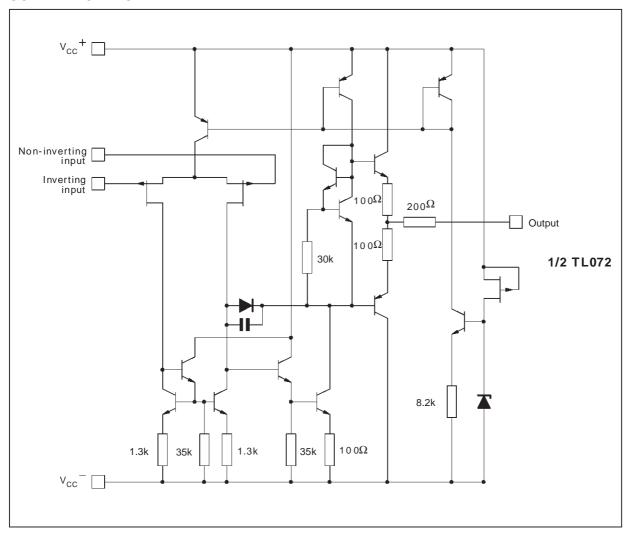
| Part Number | Temperature | Package | | |
|------------------|---------------|---------|---|--|
| Part Number | Range | N | D | |
| TL072M/AM/BM | −55°C, +125°C | • | • | |
| TL072I/AI/BI | −40°C, +105°C | • | • | |
| TL072C/AC/BC | 0°C, +70°C | • | • | |
| Example : TL0720 | CN | • | • | |

PIN CONNECTIONS (top view)



December 1998 1/9

SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit | |
|-------------------|--|--|-------------------------------------|----|
| Vcc | Supply Voltage - (note 1) | | ±18 | V |
| Vi | Input Voltage - (note 3) | | ±15 | V |
| V _{id} | Differential Input Voltage - (note 2) | | ±30 | V |
| P _{tot} | Power Dissipation | | 680 | mW |
| | Output Short-circuit Duration - (note 4) | | Infinite | |
| T _{oper} | Operating Free Air Temperature Range | TL072C,AC,BC TL072I,AI,BI TL072M,AM,BM | 0 to 70 -40 to 105 -55 to 125 | °C |
| T _{stg} | Storage Temperature Range | | -65 to 150 | °C |

Notes:

- All voltage values, except differential voltage, are with respect to the zero reference level (ground) of the supply voltages where the zero reference level is the midpoint between V_{CC}⁺ and V_{CC}⁻.
 Differential voltages are at the non-inverting input terminal with respect to the inverting input terminal.
 The magnitude of the input voltage must never exceed the magnitude of the supply voltage or 15 volts, whichever is less.
 The output may be shorted to ground or to either supply. Temperature and /or supply voltages must be limited to ensure that the dissipation rating is not exceeded.

ELECTRICAL CHARACTERISTICS

 $V_{CC} = \pm 15V$, $T_{amb} = 25^{\circ}C$ (unless otherwise specified)

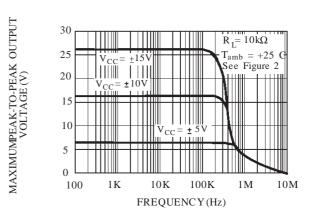
| Symbol | Parameter | | TL072I,M,AC,AI, AM,BC,BI,BM | | | TL072C | | |
|----------------------------------|--|----------------------|--------------------------------|------------------------------|----------------------|------------------|------------|--------------------------------------|
| | | Min. | Тур. | Max. | Min. | Тур. | Max. | |
| Vio | $\begin{array}{c} \text{Input Offset Voltage } (R_S=50\Omega) \\ T_{amb}=25^{\circ}C \\ TL072 \\ TL072A \\ TL072B \\ T_{min.} \leq T_{amb} \leq T_{max.} \\ TL072 \\ TL072 \\ TL072 \\ TL072A \\ TL072B \end{array}$ | | 3 3 1 | 10 6 3 13 7 5 | | 3 | 10 | mV |
| DVio | Input Offset Voltage Drift | | 10 | | | 10 | | μV/°C |
| l _{io} | Input Offset Current * $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$ | | 5 | 100 4 | | 5 | 100 10 | pA nA |
| l _{ib} | | | 20 | 200 20 | | 20 | 200 20 | pA nA |
| A _{vd} | $ \begin{array}{l} \text{Large Signal Voltage Gain } (R_L = 2k\Omega, \ V_O = \pm 10V) \\ T_{amb} = 25^{\circ}C \\ T_{min.} \leq T_{amb} \leq T_{max.} \end{array} $ | 50 25 | 200 | | 25 15 | 200 | | V/mV |
| SVR | Supply Voltage Rejection Ratio (R _S = 50Ω) $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$ | 80 80 | 86 | | 70 70 | 86 | | dB |
| Icc | Supply Current, per Amp, no Load $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$ | | 1.4 | 2.5 2.5 | | 1.4 | 2.5 2.5 | mA |
| V _{icm} | Input Common Mode Voltage Range | | +15 -12 | | ±11 | +15 -12 | | V |
| CMR | Common Mode Rejection Ratio (R _S = 50Ω) $T_{amb} = 25^{\circ}C$ $T_{min.} \le T_{amb} \le T_{max.}$ | 80 80 | 86 | | 70 70 | 86 | | dB |
| los | Output Short-circuit Current $T_{amb} = 25^{\circ}C$ $T_{min.} \leq T_{amb} \leq T_{max.}$ | 10 10 | 40 | 60 60 | 10 10 | 40 | 60 60 | mA |
| ±V _{OPP} | $ \begin{array}{ll} \text{Output Voltage Swing} \\ T_{amb} = 25^{\circ}\text{C} & R_{L} = 2k\Omega \\ R_{L} = 10k\Omega \\ T_{min.} \leq T_{amb} \leq T_{max.} & R_{L} = 2k\Omega \\ R_{L} = 10k\Omega \end{array} $ | 10 12 10 12 | 12 13.5 | | 10 12 10 12 | 12 13.5 | | V |
| SR | Slew Rate (V_{in} = 10V, R_L = 2k Ω , C_L = 100pF, T_{amb} = 25°C, unity gain) | 8 | 16 | | 8 | 16 | | V/µs |
| t _r | Rise Time (V_{in} = 20mV, R_L = 2k Ω , C_L = 100pF, T_{amb} = 25°C, unity gain) | | 0.1 | | | 0.1 | | μs |
| K _{OV} | Overshoot ($V_{in} = 20$ mV, $R_L = 2$ k Ω , $C_L = 100$ pF, $T_{amb} = 25$ °C, unity gain) | | 10 | | | 10 | | % |
| GBP | Gain Bandwidth Product (f = 100kHz, $T_{amb} = 25^{\circ}C$, $V_{in} = 10$ mV, $R_L = 2$ k Ω , $C_L = 100$ pF) | | 4 | | 2.5 | 4 | | MHz |
| Ri | Input Resistance | | 10 ¹² | | | 10 ¹² | | Ω |
| THD | Total Harmonic Distortion (f = 1kHz, A_V = 20dB, R_L = 2k Ω , C_L = 100pF, T_{amb} = 25°C, V_O = 2V _{PP}) | | 0.01 | | | 0.01 | | % |
| en | Equivalent Input Noise Voltage (f = 1kHz, $R_s = 100\Omega$) | | 15 | | | 15 | | $\frac{\text{nV}}{\sqrt{\text{Hz}}}$ |
| Øm | Phase Margin | | 45 | | | 45 | | Degrees |
| V _{O1} /V _{O2} | Channel Separation (A _v = 100) | | 120 | | | 120 | | dB |

^{*} The input bias currents are junction leakage currents which approximately double for every 10°C increase in the junction temperature.

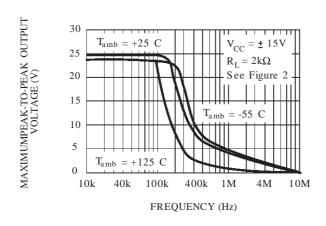
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY

V_{CC} = ± 15V $R_L = 2k\Omega$ MAXIMUM PEAK-TO-PEAKOUTPUT 25 See Figure 2 20 VOLTAGE (V) ± 10V 15 10 $V_{CC} = \pm 5V$ 5 100K 1K 10K 1M 10M 100 FREQUENCY (Hz)

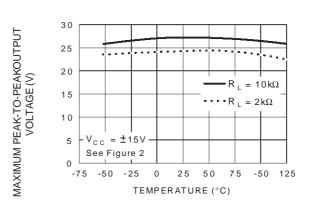
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



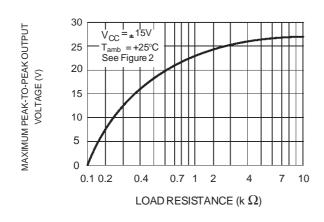
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREQUENCY



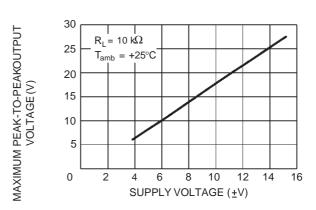
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS FREE AIR TEMP.



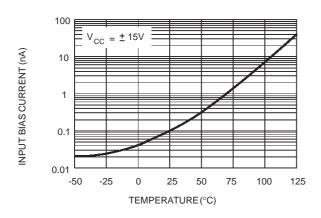
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS LOAD RESISTANCE



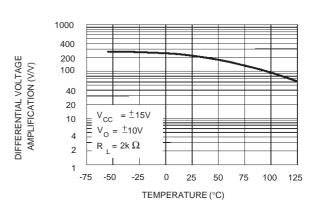
MAXIMUM PEAK-TO-PEAK OUTPUT VOLTAGE VERSUS SUPPLY VOLTAGE



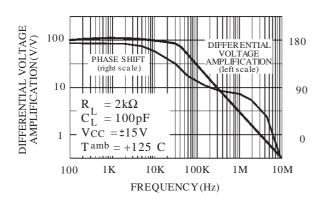
INPUT BIAS CURRENT VERSUS FREE AIR TEMPERATURE



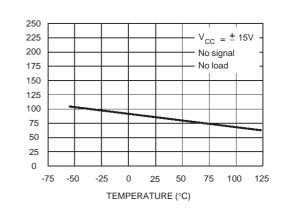
LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION VERSUS FREE AIR TEMPERATURE



LARGE SIGNAL DIFFERENTIAL VOLTAGE AMPLIFICATION AND PHASE SHIFT VERSUS FREQUENCY



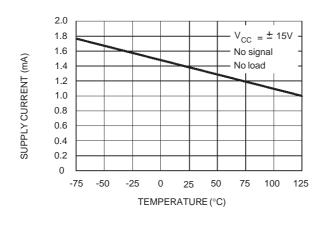
TOTAL POWER DISSIPATION VERSUS FREE AIR TEMPERATURE



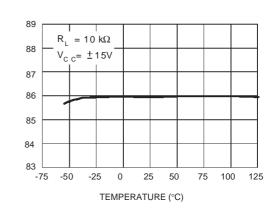
TOTAL POWER DISSIPATION (mW)

COMMON MODE MODE REJECTION

SUPPLY CURRENT PER AMPLIFIER VERSUS FREE AIR TEMPERATURE



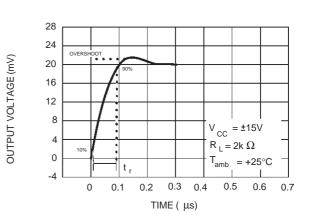
COMMON MODE REJECTION RATIO VERSUS FREE AIR TEMPERATURE



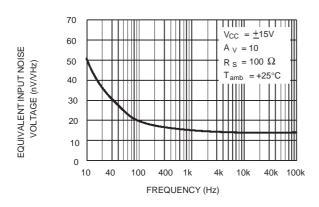
VOLTAGE FOLLOWER LARGE SIGNAL PULSE RESPONSE

INPUT AND OUTPUT VOLTAGES (V) 4 OUTPUT INPUT 2 0 $V_{CC} = \pm 15 V$ -2 $R_L = 2 k\Omega$ $C_L = 100pF$ -4 $T_{amb} = +25 \text{ C}$ -6 0.5 1.5 TIME (µs)

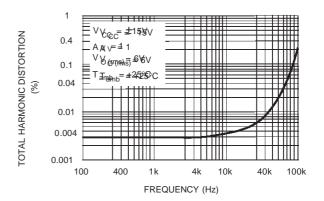
OUTPUT VOLTAGE VERSUS ELAPSED TIME



EQUIVALENT INPUT NOISE VOLTAGE VERSUS FREQUENCY



TOTAL HARMONIC DISTORTION VERSUS FREQUENCY



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PARAMETER MEASUREMENT INFORMATION

Figure 1: Voltage Follower

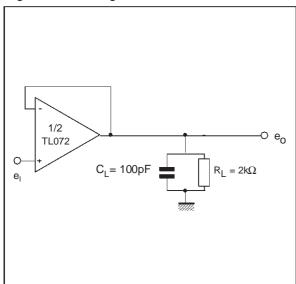
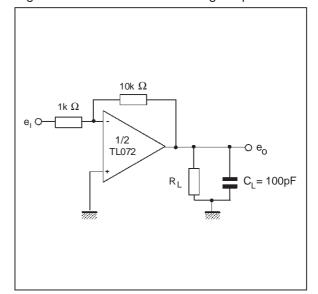
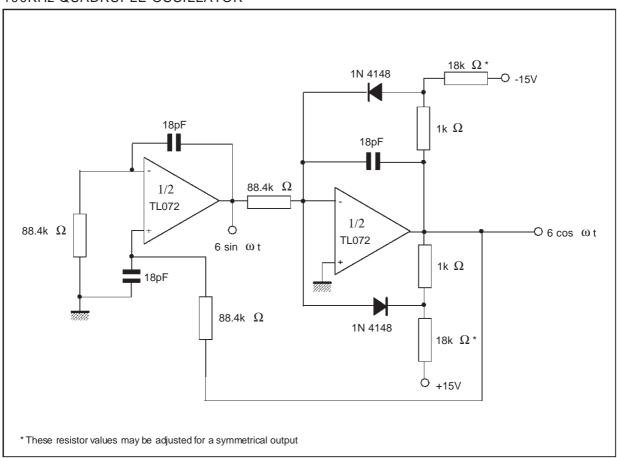


Figure 2: Gain-of-10 Inverting Amplifier



TYPICAL APPLICATION

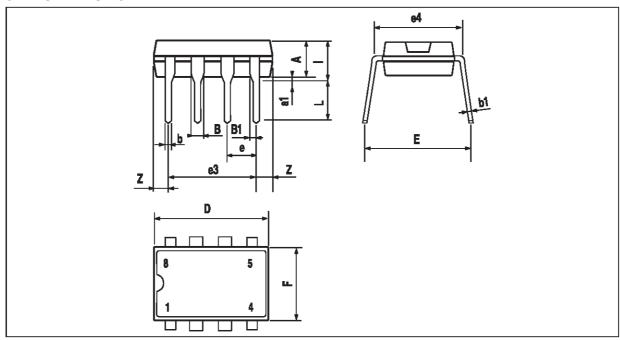
100KHz QUADRUPLE OSCILLATOR



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PACKAGE MECHANICAL DATA

8 PINS - PLASTIC DIP

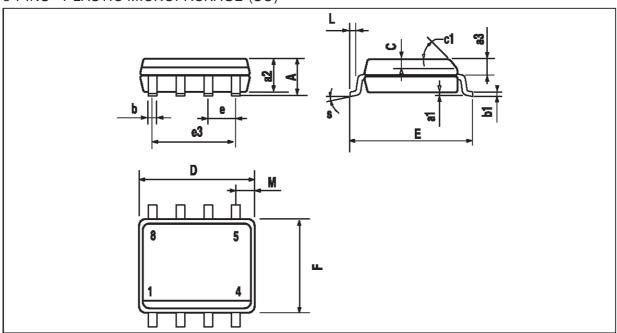


| Dimensions | Millimeters | | | Inches | | | |
|------------|-------------|-------------|-------|--------|-------|-------|--|
| Dimensions | Min. | Min. Typ. N | | Min. | Тур. | Max. | |
| Α | | 3.32 | | | 0.131 | | |
| a1 | 0.51 | | | 0.020 | | | |
| В | 1.15 | | 1.65 | 0.045 | | 0.065 | |
| b | 0.356 | | 0.55 | 0.014 | | 0.022 | |
| b1 | 0.204 | | 0.304 | 0.008 | | 0.012 | |
| D | | | 10.92 | | | 0.430 | |
| E | 7.95 | | 9.75 | 0.313 | | 0.384 | |
| е | | 2.54 | | | 0.100 | | |
| e3 | | 7.62 | | | 0.300 | | |
| e4 | | 7.62 | | | 0.300 | | |
| F | | | 6.6 | | | 0260 | |
| i | | | 5.08 | | | 0.200 | |
| L | 3.18 | | 3.81 | 0.125 | | 0.150 | |
| Z | | | 1.52 | | | 0.060 | |

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PACKAGE MECHANICAL DATA

8 PINS - PLASTIC MICROPACKAGE (SO)



| Dimensions | Millimeters | | | Inches | | | |
|------------|-------------|------|------|--------|-------|-------|--|
| | Min. | Тур. | Max. | Min. | Тур. | Max. | |
| Α | | | 1.75 | | | 0.069 | |
| a1 | 0.1 | | 0.25 | 0.004 | | 0.010 | |
| a2 | | | 1.65 | | | 0.065 | |
| a3 | 0.65 | | 0.85 | 0.026 | | 0.033 | |
| b | 0.35 | | 0.48 | 0.014 | | 0.019 | |
| b1 | 0.19 | | 0.25 | 0.007 | | 0.010 | |
| С | 0.25 | | 0.5 | 0.010 | | 0.020 | |
| c1 | | | 45° | (typ.) | | | |
| D | 4.8 | | 5.0 | 0.189 | | 0.197 | |
| E | 5.8 | | 6.2 | 0.228 | | 0.244 | |
| е | | 1.27 | | | 0.050 | | |
| e3 | | 3.81 | | | 0.150 | | |
| F | 3.8 | | 4.0 | 0.150 | | 0.157 | |
| L | 0.4 | | 1.27 | 0.016 | | 0.050 | |
| М | | | 0.6 | | | 0.024 | |
| S | 8° (max.) | | | | | | |

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